3. Condensate System

3. Condensate System

3.1 System Description

The Condensate System in the CEP collects and stores the steam condensate from Building 215 (existing hospital) and the new ACF. The system consists mainly of the condensate tank CDT-1 and the condensate pumps CDP-1 and CDP-2. The system is the original system used in the original boiler plant. It has been upgraded as part of the new CEP project with new controls and is now monitored and controlled by the DCCS.

In general, there are two types of condensate systems: pressurized and non-pressurized. The pressurized system uses steam to move the condensate while the non-pressurized system uses pumps. The condensate system in the CEP is a non-pressurized system. The condensate tank operates at atmospheric pressure with a vent line from the tank installed to the roof.

Major Equipment Description:

- Condensate Tank

  The condensate tank CDT-1 is located on the south side of the CEP near the chiller area. The tank has a capacity of _____ gallons, a design pressure of 15 psig and a design temperature of 300^0F. The tank is constructed in accordance with ASME Boiler and Pressure Vessel Code Section VIII.

- Condensate Pumps

  There are two (2) condensate pumps CDP-1 and CDP-2 located under the condensate tank. Each pump is equipped with a _____ hp motor and has a capacity of _____ gpm at _____ feet of head.

3.2 Normal Operating Conditions

3.2.1 Normal Operating Description (refer to drawing C-1):

The condensate tank CDT-1 collects and stores steam condensate from Building 215, the ACF and the CEP. Building 215 and the new ACF have separate condensate receivers as part of their condensate return systems. Condensate from these receivers is pumped into condensate tank CDT-1. Condensate from the CEP is fed via gravity into the condensate tank CDT-1.

Mounted below the tank are the condensate pumps CDP-1 and CDP-2. These pumps move the condensate from the condensate tank to the deaerator DA-1. The rate of condensate flow into the deaerator is controlled by a pneumatically-operated flow control valve, located next to the condensate tank. The flow control valve modulates, based on a DCCS level controller, to maintain a preset level in the tank. The DCCS level controller, which is mounted on the tank, replaces the existing level valve, which has been disconnected.

The amount of condensate pumped to the deaerator changes according to the flow control valve. As the valve closes, the condensate is pumped back into the condensate tank through a bypass line. The flow control valve closing causes the pressure in the condensate line to rise above the pressure setting of the bypass orifices.

The DCCS monitors and controls the condensate system. The DCCS monitors the following:

- Condensate Temperature (TT)
- Condensate Flow to DA-1 (FT)
- Condensate Tank Level
- Condensate Pump Status (Start/Stop)

From the DCCS control console, the pumps can be set up in LOCAL or REMOTE mode. In LOCAL mode, the pumps are controlled from the local control panel next to the pumps. In REMOTE mode, the pumps are controlled at the DCCS control console.

3.3 OMSI Drawings and Photographs

The following OMSI photographs are included for this system:

Figure 1: Typical Condensate Pump (CDP)

The following OMSI drawings have been developed for this system:

C-1 Condensate System Flow Diagram

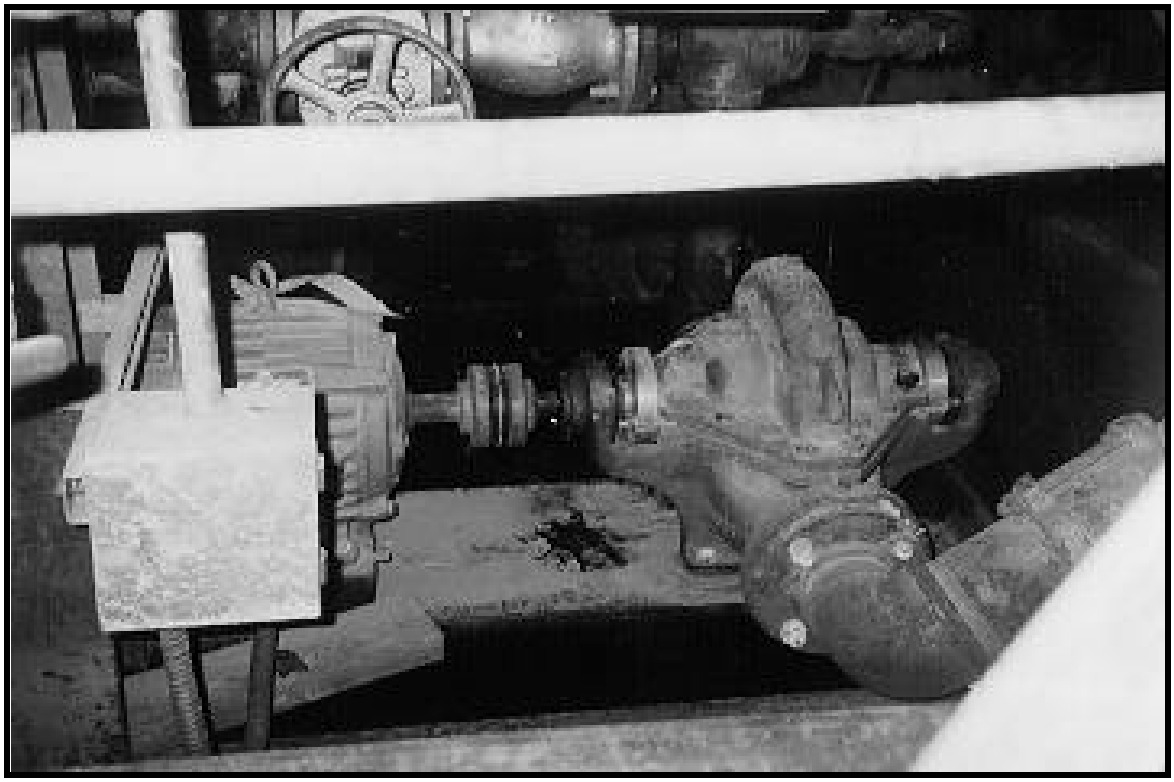

Figure 1: Condensate Pump (CDP)

3.4 System Startup and Shutdown Procedures

The startup and shutdown of the condensate system is controlled by the DCCS. Under normal conditions the condensate system should always be operating. However during maintenance, the condensate may be sent directly to the sanitary sewer. In this case, the following startup and shutdown procedures should be used.

System Startup Procedure:

1. Verify manually operated valves are in the proper position. Verify that the bypass valves around the flow control valve and flow transmitter are closed.

2. At the DCCS control console, place the condensate pump in REMOTE mode.

3. At the pumps, place the local disconnect switch into the ON position.

4. Open the condensate cutoff valve so that the condensate tank begins to fill with condensate. The condensate will flow into the tank instead of into the sanitary sewer.

5. At the DCCS control console, monitor the level of the tank. Once it reaches the normal operating level, start condensate pumps CDP-1 and CDP-2. Note: Do not run pumps dry.

6. Verify proper operation of the DCCS level controller, the flow control valve and the pumps.

System Shutdown Procedure:

1. Close the condensate cutoff valve so that the condensate flows into the sanitary sewer.

2. At the pumps, place the local disconnect into the OFF position.

3. Wait for temperature of condensate in tank to cool down before performing maintenance.

3.5 Emergency Procedures

Most emergency situations are handled automatically by the DCCS. For troubleshooting procedures, refer to section 3.12.

3.6 Environmental Considerations

In terms of environmental considerations, the *Condensate System* in the CEP does not require any special environmental operation, reporting, testing, analysis or inspection. Note however that water which is discharged to the sanitary sewer should not exceed 140^0F.

3.7 Safety Instructions

In addition to the *General Safety Instructions* at the beginning of each binder, refer to the following:

1. Prior to any maintenance procedures of the condensate tank or condensate pumps, all isolating valves shall be closed.

2. Ensure that water temperature is down to safe working limit before dismantling system components and pipelines.

3.8 Valve List

Valve #	Size	Location	Serves	Type	Normal Position

3.9 Operator Servicing Requirements

The operator servicing requirements are defined as maintenance tasks that need to be performed on a daily basis. Regularly scheduled maintenance tasks that are performed less frequently (e.g., weekly, monthly) are classified as preventive maintenance and are described in sections 3.10 and 3.11.

1. Check the operation of the level controller to ensure that the control valve opens when the level of water in the tank reaches the predetermined level.

2. Every hour, verify that one of the condensate pumps is running.

Normal Operating Parameters:

Condensate input temperature at CDT-1 . . . . . approx. 200F
Condensate output temperature at CDT-1 . . . . . 140F
Normal pressure in CDT-1 . . . . . 0 psig

3.10 Preventive Maintenance (PM) Plan

Preventive Maintenance for the **Condensate System** is composed of two parts. This section is a PM Plan, which for each equipment type in the CEP, provides the PM procedures numbers, and frequencies. The section is arranged by equipment type.

Section 3.11 contains the PM procedures for the CEP equipment. The section is arranged by PM procedure number.

PM Plan: Condensate System			
Equipment Description	**Equipment #**	**PM #**	**Frequency**
Condensate Tank	CDT-1	030001	Annual
Condensate Pumps	CDP-1 and CDP-2	030002	Semiannual

3.11 Preventive Maintenance (PM) Procedures

Task #: 030001	**Description: Condensate Tank**
Time Required: 1 hour	**Frequency:** Annual
Skill Level: Operating Engineer	
Special Tools:	
Safety Precautions:	
Step 1. Inspect tank for corrosion or deterioration. Step 2. Inspect all piping, valves and fittings for leaks. Step 3. Check level meter for damage or leaks. Clean if required. Step 4. Operate all valves and lubricate as required. Step 5. Inspect tank insulation for damage. Repair as required.	

Task #: 030002	Description: Condensate Pump
Time Required:	**Frequency:** Semiannual
Skill Level: Mechanic	
Special Tools:	
Safety Precautions:	

Step 1: Lubricate motor bearings using a manufacturer's recommended grease. **Do not overgrease the motor.**

Step 2: Remove drain plug and flush unit with water unit it runs clear.

Step 3: Inspect level glass and clean if required.

Step 4: Insure proper operation of level controls. Units with two pumps are provided with a two stage float switch that will start one pump at one level and the other at a higher level. Adjust or repair any deficiencies as required.

Step 5: Notify personnel monitoring the **DCCS** that you will be checking the high level alarm on the condensate pumps. Open contacts on high level alarm and verify that the **DCCS** records the alarm.

3.12 Corrective Maintenance (Troubleshooting)

#	Problem	Probable Cause and Corrective Action
1	**General**	
	Procedures for the system presented here relate to system functioning only. The following steps should be incorporated into each troubleshooting procedure whenever related equipment has been shut down by an actuated alarm or a system component breakdown. Depending upon the nature of the trouble, take whatever precautions are necessary to safeguard personnel, property and equipment. Determine the most likely causes of the system malfunction and, by the process of elimination, find the actual cause. Correct the faulty condition. A check of corrective measures must be taken to prevent a reoccurrence. Activate the repaired equipment and ascertain that it works properly. Return the system to normal operation.	
2	**Condensate Pump does not Run**	**1. No power at motor.**
		A. Check for voltage at motor terminal box. If no voltage at motor, check motor control center for tripped circuits and reset circuits.
		2. Circuit breaker is tripped.
		A. Place circuit breaker at motor control center to ON position. If breaker trips again, the electrical installation, motor and wires must be checked.
		3. Motor starter overloads are burned or have tripped out.

#	Problem	Probable Cause and Corrective Action
		A. Check for voltage on line and load side of starter. Replace burned heaters or reset. Inspect starter for other damage. If heater trips again, check the supply voltage and starter holding coil.
		4. Starter does not energize.
		A. Energize control circuit and check for voltage at the holding coil. If no voltage
		5. Defective controls.
		A. Check all safety and pressure switches for operation. Inspect contacts in control devices. Replace worn or defective parts or controls.
		6. Motor is defective.
		A. Turn off power and disconnect wiring. Measure the lead resistances with ohmmeter. Measure lead to ground values with ohmmeter. Record measured values. If an open or grounded winding is found, remove motor and repair or replace.
		7. Pump is bound.
		A. Turn off power and manually rotate pump shaft. If shaft does not rotate easily, check coupling setting and adjust as necessary. If shaft rotation is still tight, remove pump and inspect. Disassemble and repair.
3	**Pump Runs but at Reduced Capacity or does not Deliver Water**	**1. Wrong rotation.**
		A. Check wiring for proper connections. Correct wiring.
		2. Pump is not primed or is airbound.

#	Problem	Probable Cause and Corrective Action
		A. Turn pump off, close isolation valve(s), remove priming plug. Check fluid level. Refill the pump, replace plug and start the pump. Long suction lines must be filled before starting the pump.
		3. Strainers, check or foot valves are clogged.
		A. Remove strainer, screen or valve and inspect. Clean and replace. Reprime pump.
		4. Suction lift too large.
		A. Install compound pressure gauge at the suction side of the pump. Start pump and compare reading to performance data. Reduce suction lift by lowering pump, increase suction line size or removing high friction loss devices.
		5. Suction and/or discharge piping leaks.
		A. Pump runs backwards when turned off. Air in suction pipe. Suction pipe, valves and fittings must be airtight. Repair any leaks and retighten all loose fittings.
		6. Pump worn.
		A. Install pressure gauge, start pump, gradually close the discharge valve and read pressure at shutoff. Convert measured pressure to head. Refer to the specific pump curve for shutoff head for that pump model. If head is close to curve, pump is probably OK. If not, remove pump and inspect.
		7. Pump impeller or guide vane is clogged.
		A. Disassemble and inspect pump passageways. Remove any foreign materials found.

#	Problem	Probable Cause and Corrective Action
4	**Circuit Breakers or Overload Relays Trip**	**1. Low voltage.**
		A. Check voltage at starter panel and motor. If voltage varies more than +/-10%, contact power company. Check wire sizing
		2. Motor overloads are set too low.
		A. Cycle pump and measure amperage. Increase heater size or adjust trip setting to a maximum of motor nameplate (full load) current.
		3. Three-phase current is imbalanced.
		A. Check current draw on each lead to the motor. Must be within +/-5%. If not, check motor and wiring. Rotating all leads may eliminate this problem.
		4. Motor is shorted or grounded.
		A. Turn off power and disconnect wiring. Measure the lead-to-lead resistance with an ohmmeter. Measure load-to-ground values with an ohmmeter or a megaohm meter. Record values. If an open or grounded winding is found, remove the motor, repair and/or replace.
		5. Wiring or connections are faulty.
		A. Check power wiring and loose terminals. Replace damaged wire.
		6. Pump is bound.
		A. Turn off power and manually rotate pump shaft. If shaft does not rotate easily, check coupling setting and adjust as necessary. If shaft rotation is still tight, remove pump and inspect. Disassemble and repair.
		7. Motor overloads at higher ambient temperature than motor.

#	Problem	Probable Cause and Corrective Action
		A. Use a thermometer to check the ambient temperature near the overloads and motor. Record these values. If ambient temperature at motor is lower than at overloads, especially where temperature at overloads, especially where temperature at overloads is above 104^0F, ambient-compensated heaters should replace standard heaters.
4	**Pump Runs but No Condensate is Transferred to Deaerator**	**1. Control valve does not open.**
		A. Check if control air is available at the valve.
		B. Check if there is signal coming from DCCS.

3.13 Key Names, Addresses and Telephone Numbers

DCCS Manufacturer:
Bailey Controls Company
4250 International Blvd, Suite
Norcross, GA 30093
Reference Job #179V
404-279-6100
P.O.C. Mr. Tom Grisafe
Mr. Bill Allen, Project Engineer
404-279-6100

Controls Contractor:
Quality Panels, Inc.
820 Greenbrier Circle, Suite 28
Chesapeake, Virginia 23320
804-366-0753 Fax 804-424-2393
P.O.C. Mr. John (Sid) Sidlovsky, Vice President/General Manager